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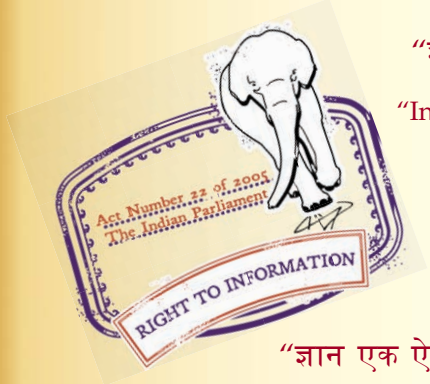
IS 8201 (1976): High Frequency Wideband Matching Transformer [LITD 5: Semiconductor and Other Electronic Components and Devices]



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Indian Standard

SPECIFICATION FOR HIGH FREQUENCY WIDEBAND MATCHING TRANSFORMER

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Indian Standard

SPECIFICATION FOR HIGH FREQUENCY WIDEBAND MATCHING TRANSFORMER

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Indian Standard

SPECIFICATION FOR HIGH FREQUENCY WIDEBAND MATCHING TRANSFORMER

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 7 September 1976, after the draft finalized by the Transformers and Inductors for Electronic Equipment Sectional Committee had been approved by the Electronics and Telecommunications Division Council.

0.2 This standard lays down the methods of test and general requirements applicable to high frequency (hf) wideband impedance matching transformers used for balanced to unbalanced coupling and impedance transformation, in electronic and telecommunication equipment. These transformers are commonly known as baluns.

0.3 This standard is one of a series of Indian Standards on transformers and inductors for electronic equipment. A list of standards so far published in this series is given on page 18.

0.4 It is recognized that in the case of components like wideband matching transformers, the performance requirements are related to the design of the particular circuit for which they are intended and it would, therefore, be difficult to lay down specific values for all characteristics independent of the equipment design. The intending purchaser should, therefore, furnish details of additional requirements of the component. A list of items for which the purchaser should specify the requirements is given in Appendix A.

0.5 This standard requires reference to IS : 589-1961* as far as the details of the climatic and mechanical testing procedures are concerned. Only the relevant degrees of severity have been specified in this standard.

0.6 In the preparation of this standard assistance has been derived from the following:

JSS 54680 General specification for matching transformers (balun). Directorate of Standardization, Department of Defence Production, Ministry of Defence.

*Basic climatic and mechanical durability tests for electronic components (*revised*).

MIL-T-28732B(EC) Transformer, impedance matching (balun). Department of Defence, USA.

MIL-T-28767(EC) Transformer, impedance matching (balun). Department of Defence, USA.

0.7 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS:2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard lays down the methods of tests and general requirements applicable to high frequency (hf) wideband impedance matching transformers (baluns) used for balanced to unbalanced coupling and impedance transformation, in electronic and telecommunication equipment.

1.1.1 The transformers covered are meant for operation over frequency range 1·5 to 30 MHz having unbalanced impedances between 50 and 75 ohms or balanced impedances between 50 and 600 ohms.

1.2 The matching transformers covered include:

a) high power matching transformers for transmitting systems for matching balanced or unbalanced feeder sources and loads over a wide range of impedance ratios, and

b) low power matching transformers for receiving systems for matching balanced antenna and unbalanced transmission lines over a wide range of impedance ratios.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Type Tests — Tests carried out to prove conformity with the requirements of this standard. They are intended to prove the general qualities and design of a particular type of transformer.

2.2 Acceptance Tests — Tests carried out on samples of transformers selected from a lot for the purpose of acceptance of the lot.

*Rules for rounding off numerical values (*revised*).

2.2.1 *Lot* — All transformers of the same grade and rating manufactured by the same factory during the same period.

2.3 Routine Tests — Tests carried out on each transformer to check the requirements which are likely to vary during production.

3. CLIMATIC CATEGORIES AND TYPES

3.1 Climatic Categories — The hf transformers shall belong to one of the following three categories based on their ability to withstand the climatic severities:

Climatic Test (*See* IS : 589-1961*)	*Severity*		
	Category 1	Category 2	Category 3
Dry heat	+100°C	+85°C	+70°C
Cold	−55°C	−40°C	−10°C
Damp heat (long term)	56 days	56 days	21 days
Damp heat (accelerated)	6 cycles	6 cycles	2 cycles
Rapid change of temperature	+100°C to −55°C	+85°C to −40°C	Not applicable
Low air pressure	44 mbar	300 mbar	600 mbar

NOTE 1 — A recovery period of 24 hours after the damp heat (accelerated) and damp heat (long term) tests is necessary for Category 3 components.

NOTE 2 — In special cases where the above categories are not applicable other combinations of severities may be agreed to between the purchaser and the manufacturer provided such severities are chosen from IS : 589-1961*.

4. RATINGS

4.1 The power ratings in kW should be chosen from R10 series (*see* IS : 1076-1967†) given below, the italicized values being preferred:

1, 1·25, 1·6, 2·0, *2·5*, 3·15, *5·0*, 6·3, *8·0* or their decimal multiples and sub-multiples.

5. MATERIALS, CONSTRUCTION AND WORKMANSHIP

5.1 Materials — The transformer shall be constructed from materials free from flaws and other defects. As far as practicable, materials used for construction shall be nonflammable, nonexplosive and noncorrosive.

*Basic climatic and mechanical durability tests for electronic components (*revised*).
†Preferred numbers (*first revision*).

5.2 Construction

5.2.1 The principal features include hermetic sealing to withstand severe environmental conditions, simple mounting arrangements, small size and weight and oil-filled construction in the case of high power transformers.

5.2.2 The windings, internal wiring and assembly in the housing shall be rigid and secure so that intermittent contact due to vibration shall not occur during transportation or use. Suitable coaxial connectors to match the impedance and power handling capacity and to meet environmental requirements shall be used. The balanced terminals shall be of suitable type and size and at spacings as required (*see* Appendix A). An external grounding termination shall be provided on the transformer if required. The housing should be such as to provide shielding against stray electromagnetic fields and to preclude stray radiation from the transformer. Each of the balanced terminals shall be provided with lightning protection if required.

5.2.3 Oil-filled units shall be filled with suitable oils and shall be ensured to be leak-free in any position. They may be provided with suitable gaskets and oil level indicators if required. The enclosure should be such that with oil to the correct level there shall be an air space at the top to absorb expansion of oil or increase in internal pressure. The enclosure shall be constructed entirely of aluminium, cast or welded. They shall stand an internal pressure of 250 kPa and have a leakage rate of 0·000 04 cm^3/s at 100 kPa. Enclosures of transformers of rating higher than 10 kW (average) shall be provided with suitable handles to facilitate handling.

5.3 Finish — Unless otherwise specified, all exposed materials liable to deterioration in moist or other corrosive atmosphere shall be given suitable finish.

5.4 Workmanship — All parts of the transformer shall be manufactured in a thoroughly workmanlike manner and in accordance with good engineering practice.

6. MARKING

6.1 Each transformer shall be clearly and indelibly marked with the following:

a) Manufacturer's name or trade-mark;

b) Manufacturer's code/type number;

c) Terminal identification with impedances;

d) Power and frequency range; and

e) Any other marking, such as batch number, date, schematic drawing, etc, as agreed to between the purchaser and the manufacturer.

6.2 In addition to the marking specified in **6.1**, the following information shall be supplied in form of a detailed specification sheet along with the units:

a) Insertion loss,
b) Insertion VSWR (voltage standing wave ratio),
c) Permissible load mismatch VSWR,
d) Symmetry of balanced winding,
e) Connectors used,
f) Spacing between balanced terminals, and
g) Recommended mounting position.

7. TESTS

7.1 Classification of Tests

7.1.1 *Type Tests* — The procedure for type approval shall be in accordance with that given in IS : 2612-1965*.

7.1.1.1 *Number of samples* — The manufacturer shall submit one transformer of each type and power rating for which type approval is required.

7.1.1.2 *Sequence of type tests* — The sequence of type tests shall be in accordance with the following order:

a) *General tests*
   1) Visual examination (**7.4.1**),
   2) Dimensions (**7.4.2**),
   3) Mass (**7.4.3**),
   4) Continuity of winding (**7.3.1**),
   5) DC resistance of winding (**7.3.2**),
   6) Polarity (**7.3.5**), and
   7) Insulation resistance (**7.3.6**).

b) *Performance tests (electrical)*
   1) Primary inductance (**7.3.3**),
   2) Transformation ratio (**7.3.4**),
   3) Low level insertion VSWR (**7.3.7**),
   4) Symmetry of balanced winding (**7.3.8**),
   5) Insertion loss or efficiency (for transmitter transformers) (**7.3.10**),

*Recommendation for type approval and sampling procedures for electronic components.

6) Power and load VSWR (for transmitter transformers) (**7.3.11**),
7) Overload VSWR (**7.3.12**),
8) Spurious frequencies (where specified) (**7.3.13**), and
9) Intermodulation products (where applicable and specified) (**7.3.14**).

c) *Environmental tests*
1) Vibration (**7.4.5**),
2) Shock (**7.4.6**),
3) Climatic (**7.5**),
4) Salt mist (**7.5.7**),
5) Mould growth (**7.5.9**), and
6) Solar radiation (**7.5.8**).

7.1.2 *Acceptance Tests* — The acceptance tests as given in Table 1 shall be carried out on limited number of samples selected in accordance with the sampling procedure given in IS : 2612-1965* and on those which have passed the routine tests.

TABLE 1 ACCEPTANCE TESTS

Sl No.	Tests	AQL	Inspection Level
(1)	(2)	(3)	(4)
	Transformers for Transmitters		
i)	Dimensions (**7.4.2**)	1 percent	II
ii)	Mass (**7.4.3**)		
iii)	Spurious frequencies (**7.3.13**)		
iv)	Insertion loss/efficiency (**7.3.10**)		
v)	Power and load VSWR (**7.3.11**)		
	Transformers for Receivers		
vi)	Dimensions (**7.4.2**)	4 percent	S.3
vii)	Mass (**7.4.3**)		
viii)	Insertion loss/efficiency (**7.3.10**)		
ix)	Intermodulation products (where specified) (**7.3.14**)		

*Recommendation for type approval and sampling procedures for electronic components.

7.1.3 *Routine Tests* — The following shall constitute the routine tests:

a) Visual examination (**7.4.1**),
b) Continuity of winding (**7.3.1**),
c) DC resistance of winding (**7.3.2**),
d) Primary inductance (**7.3.3**),
e) Transformation ratio (**7.3.4**),
f) Polarity (**7.3.5**),
g) Insulation resistance (**7.3.6**),
h) Low level insertion VSWR (**7.3.7**),
j) Symmetry of balanced winding (**7.3.8**), and
k) Power test (routine) (for transmitter transformer) (**7.3.9**).

7.2 General Conditions for Tests

7.2.1 Tests shall be carried out on the transformers as received from the manufacturer or the supplier.

7.2.2 *Atmospheric Conditions for Testing* — Unless otherwise specified, all tests shall be carried out under standard atmospheric conditions specified in IS : 589-1961*.

7.2.3 *Preconditioning* — Before measurements are made, the transformers shall be stored at the measuring temperature and relative humidity, for a time sufficient to allow the entire transformer to reach these conditions. The recovery period called for after conditioning is adequate for this purpose.

7.2.4 *Correction to be Applied* — When measurements are made at an ambient temperature other than the reference temperature, the results shall, where necessary, be corrected to the reference temperature. The ambient temperature during the tests shall be stated in the test report.

7.2.5 *Other Precautions* — During measurements, the transformers shall not be exposed to draughts, direct sunrays or other influences likely to cause errors.

7.3 Electrical Tests

7.3.1 *Continuity of Winding* — Each winding of the transformer shall be tested for electrical continuity by any suitable method. Each winding shall be continuous.

7.3.2 *DC Resistance of Winding* — The transformer shall be maintained under normal atmospheric conditions and the dc resistance of each winding shall be measured, the ambient temperature being simultaneously recorded. Unless otherwise specified, the value shall be referred to the temperature of 27°C and this value shall be within the tolerance limits specified in the relevant Indian Standard.

*Basic climatic and mechanical durability tests for electronic components (*revised*).

7.3.3 *Primary Inductance* — The primary inductance shall be measured at the specified frequency and voltage. The values shall be as specified in the relevant Indian Standards.

7.3.4 *Transformation Ratio* — The transformation ratio of the transformer shall be computed from the ratio of voltages measured across the required winding with the secondary open-circuited, at the specified frequency and voltage the measurement being done with a high impedance voltmeter. The values shall be as specified in the relevant Indian Standards.

7.3.5 *Polarity* — Where applicable, the polarity shall be checked by a suitable method. The polarity shall be as specified in the relevant Indian Standard.

7.3.6 *Insulation Resistance* — Unless otherwise specified, the insulation resistance shall be measured by applying a dc test voltage of 500 V for one minute ±5 seconds between the case and each winding, and between windings.

7.3.6.1 The insulation resistance shall be not less than 1 000 MΩ unless otherwise specified.

7.3.7 *Low Level Insertion VSWR* — The impedance at the input terminals of the properly terminated transformer shall be measured by a bridge or equivalent method. Each measured value shall be normalized and plotted on a Smith chart. The test shall be conducted at 1·5, 2, 4, 6, 9, 12, 15, 18, 28, 30 MHz for acceptance tests and 1·5, 2, 4, 9, 18, 28, and 30 MHz for routine test. The values shall be as specified in the relevant Indian Standards or 2 from 1·5 to 3 MHz range and 1·2 from 3 to 30 MHz.

7.3.8 *Symmetry of Balanced Winding* — The two balanced terminals associated with ground system is considered as a three terminal system with direct admittances Y_1, Y_2 and Y_3 involved (Fig. 1).

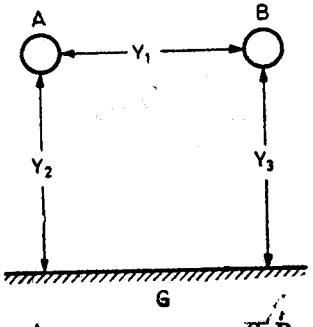

FIG. 1 ADMITTANCES ASSOCIATED WITH 2 BALANCED TERMINALS TO BE CONNECTED TO A LINE

Three measurements are made as follows:

a) The admittance Y' between electrode A and ground with electrode B grounded,

b) The admittance Y'' between A and ground with AB short-circuited, and

c) The admittance Y''' between B and ground with A grounded.

These measurements give:

$$Y' = Y_1 + Y_2$$
$$Y'' = Y_2 + Y_3$$
$$Y''' = Y_1 + Y_3$$

Solving for Y_1, Y_2 and Y_3 gives:

$$Y_2 = \frac{Y' + Y'' - Y'''}{2}$$

$$Y_3 = \frac{Y' + Y'' + Y'''}{2}$$

This enables to calculate the degree of symmetry given by the following equation:

$$\text{Degree of symmetry} = 20 \log_{10} \frac{Y_2}{Y_2 - Y_3} \text{ dB}$$

The values shall be as specified in the relevant Indian Standard.

7.3.9 *Power Test (Routine)* — For the purposes of routine testing only, the power test shall consist of that described in **7.3.10** and **7.3.11** except that the duration of test shall be until thermal stability is reached (rather than 24 hours), and ambient temperature is to be the uncontrolled prevailing ambient temperature (rather than 65 ± 2°C).

7.3.10 *Insertion Loss/Efficiency (for Transformers for Transmitters)* — The efficiency of the transformer shall be measured as given below:

a) The output of the transmitter shall be connected to the input of the transformer. The balanced terminals shall be terminated with the specified matching resistive load. Full average power shall be applied at the input end. Ambient and transformer oil temperatures shall be recorded at half-hour intervals. Stabilization shall be taken as having been achieved when temperature-rise is less than 1°C per half hour.

b) RF power shall be de-energized. The transformer temperature shall be allowed to decrease to room ambient 27 ± 2°C. A suitable heating element having heat density not exceeding 3·1 W/cm², shall be inserted into the transformer and shall be connected to a variable voltage source without changing physical set-ups. Power shall be applied to the heating element until the temperature of oil is stabilized to the same temperature ±0·5°C as achieved in (a). The power input in (b) shall be equal to the power loss in (a).

The efficiency shall be calculated as:

$$\text{Efficiency} = \frac{P_{out}}{P_{in}} = \frac{P_{in}\,(a) - P_{in}\,(b) \times 100}{P_{in}\,(a)}$$

where

P_{in} = input power, and

P_{out} = output power.

The efficiency of the transformer shall be verified at 1·5, 2, 4, 6, 9, 15, 20, 28 and 30 MHz or at any other frequency necessary to establish performance throughout the 1·5 to 30 MHz range.

The efficiency of the transformer shall be 97 percent or better unless otherwise specified and the temperature-rise shall be within the specified limits.

7.3.11 *Power and Load VSWR (for Transformers for Transmitters)* — The transformers which have passed insertion loss/efficiency tests and have obtained thermal stability will be tested for power and load VSWR.

The transformer shall be tested with full (average and PEP) power applied over an uninterrupted 24 hour period at the most critical frequency determined by the efficiency tests with a 2·5 : 1 load VSWR or as specified. The transformer shall not be exposed to fans or forced draughts during test periods. Ambient temperature shall be 65 ± 2°C.

There shall be no evidence of arcing, any deterioration or leakage of oil. With a load VSWR of up to 2·5 : 1 or as specified the power handling capability of the transformer shall not be derated below full power.

7.3.12 *Overload VSWR* — The transformer shall be subjected to a VSWR of 4 : 1 or higher as specified for a period of 20 minutes at full power.

There shall be no damage when the transformer is subjected to overload which results from this test.

7.3.13 *Spurious Frequencies* — The signal level of spurious frequencies generated in the transformer as a result of signal distortion or other causes shall be at least 60 dB below its full power rating or as specified. This level shall be measured at the output of the transformer with any load with VSWR of up to 2·5 : 1 and unbalanced up to 25 percent with respect to ground.

The transformer shall be operating at rated power on each of the frequencies, which are 3, 4, 6, 9, 15, 20, 28 and 30 MHz.

The transformer output shall be analyzed between 0·5 and 500 MHz (excluding the operating frequency) or to check compliance with the requirements specified.

7.3.14 *Intermodulation Products* — The second and third order intermodulation products present at an output of a multicoupler system, when two 0·25 V rms signals at frequencies f_1 and f_2 (in the frequency range of the multicoupler in such a relationship that the second order product frequency equal to $f_1 \pm f_2$ and the third order product frequency equal to $2f_1 \pm f_2$ falls within the specified range of the multicoupler and outside its range from 0·1 MHz to 60 MHz) are applied to its input, shall be at least 60 dB below either of the input signals.

Measurements shall be made at the approximate frequencies specified below. Variations in these frequencies shall be permitted if necessary to avoid spurious responses in the measuring equipment. Only one output circuit need be measured provided it may be demonstrated that all outputs are identical. All measurements shall be made with the input filter in the circuit, unless otherwise stated:

f_1	f_2	(f_1+f_2) or (f_1-f_2)	$(2f_1+f_2)$ or $(2f_1-f_2)$
MHz	MHz	MHz	MHz
2·1	3·0	+ 5·1	+ 7·2
3·5	5·0	− 1·5	− 2·0
3·5	5·0	+ 8·5	+ 12·0
5·6	8·0	+ 13·6	+ 19·2
5·6	8·0	− 2·4	− 3·2
7·7	11·0	+ 18·7	+ 26·4
7·7	11·0	− 3·3	− 4·4
11·2	16·0	+ 27·2	− 6·4
11·2	16·0	− 4·8	+ 53·4
15·4	22·0	− 6·6	− 8·8
21·0	30·0	− 9·0	− 12·0
3·5	3·0	− 0·5	+ 10·0
2·2	3·0	− 0·8	− 1·4
15·4	22·0	+ 37·4	+ 52·8
30·0	21·0	+ 51·0	− 39·0
21·0	30·0	+ 51·0	+ 72·0
0·7	0·3	− 0·4	+ 1·7*
0·8	0·5	− 0·3	− 1·1*

*To be performed with input filter by-passed.

7.4 Physical and Mechanical Tests

7.4.1 *Visual Examination* — The transformer shall be visually examined for compliance with the relevant requirements of **5** and **6.**

7.4.2 *Dimensions* — The dimensions of the transformer shall be checked and they shall conform to those specified in the relevant Indian Standard.

7.4.3 *Mass* — The mass of the transformer shall be checked for compliance with those stated in the relevant Indian Standard.

7.4.4 *Enclosure Mechanical Strength* — Under consideration.

7.4.5 *Vibration* — The transformer shall be mounted as specified in **7.6.4** of IS : 589-1961* taking care that no parts are stressed and the sample shall be subjected to vibration (fatigue) test in accordance with **7.6.6** of IS : 589-1961*.

The transformer shall be in nonoperating condition during the test and shall be capable of normal operation immediately after the tests are completed.

After the test, the transformer shall be visually examined and there shall not be any damage or deterioration. The continuity of the winding shall be checked. The inductance of the transformer and low level insertion VSWR, shall be measured and shall conform to the value specified in the relevant Indian Standard.

7.4.6 *Shock* — The transformer shall be mounted as specified in **7.6.4** and shall be subjected to shock test in accordance with **7.5.2** of IS : 589-1961*. The transformer shall be in nonoperating condition during the test and shall be capable of normal operation immediately after the tests are completed.

The severity and the duration of the test shall be as indicated in the relevant Indian Standard. At the conclusion of the test, the transformers shall be visually examined and checked for continuity of winding. There shall be no loosening of parts or other mechanical damage.

7.5 Climatic Tests

7.5.1 *Dry Heat* — The transformer shall be subjected to the dry heat test in accordance with **7.2** of IS : 589-1961*. The temperature of the test chamber shall be maintained at the maximum category temperature of the transformer. The transformer shall be on full load during the exposure, if specified.

*Basic climatic and mechanical durability tests for electronic components (*revised*).

After recovery, the transformer shall be visually examined for any damage or deterioration. The continuity of winding, low level insertion VSWR and insulation resistance shall be measured and they shall be within the limits specified.

7.5.2 *Damp Heat (Accelerated) (First Cycle)* — The transformer shall be subjected to the first cycle of the damp heat (accelerated) test in accordance with **7.4** of IS : 589-1961*. The duration of the recovery shall be 1½ hours. After recovery, the transformer shall be visually examined for any damage or deterioration.

7.5.3 *Cold Test* — The transformer shall be subjected to the cold test in accordance with **7.1** of IS : 589-1961*. The temperature of the chamber shall be maintained at the minimum category temperature of the transformer. The duration of recovery period shall be 1½ hours.

After recovery, the transformer shall be visually examined for any damage or deterioration. The continuity of winding, low level insertion VSWR, and insulation resistance shall be measured and they shall be within the limits specified.

7.5.4 *Low Air Pressure* — The transformer shall be subjected to low air pressure test in accordance with **7.12** of IS : 589-1961*. The pressure shall be appropriate to the category and the duration shall be 5 minutes.

The transformer shall be in nonoperating condition during the test and shall be capable of normal operation immediately after the test. The continuity of winding, low level insertion VSWR, and insulation resistance shall be measured and they shall be within the limits specified.

7.5.5 *Damp Heat (Accelerated) (Remaining Cycles)* — The transformer shall be subjected to the remaining number of cycles of damp heat (accelerated) in accordance with **7.4** of IS : 589-1961*.

After recovery of 1½ to 2 hours for Categories 1 and 2 transformers and 24 hours for Category 3 transformers, the transformers shall be visually examined for any damage or deterioration. The continuity of winding, low level insertion VSWR, and insulation resistance shall be measured and they shall be within the limits specified.

7.5.6 *Rapid Change of Temperature* — The transformer shall be subjected to rapid change of temperature test in accordance with **7.14** of IS : 589-1961*. The number of cycles shall be one unless otherwise specified.

After recovery, the transformers shall be visually examined for any damage or deterioration. The continuity of winding, low level insertion VSWR, and insulation resistance shall be measured and they shall be within the limits specified.

*Basic climatic and mechanical durability tests for electronic components (*revised*).

7.5.7 *Salt Mist* — The transformer shall be subjected to salt mist test in accordance with **7.10** of IS : 589-1961*. The duration of exposure shall be 4 days.

After cleaning and recovery, the transformer shall be visually examined for any damage or deterioration. The continuity of winding, low level insertion VSWR, and insulation resistance shall be measured and they shall be within the limits specified.

7.5.8 *Solar Radiation* — The transformer shall be subjected to this test in accordance with IS : 2106 (Part XVII)-1973†.

After recovery transformer shall be visually examined for any damage or deterioration. The continuity of winding, low level insertion VSWR, and insulation resistance shall be measured and they shall be within the limits specified.

7.5.9 *Mould Growth* — The transformer shall be subjected to mould growth test in accordance with **7.9** of IS : 589-1961*.

At the end of the test the transformer shall be visually examined for any damage or deterioration. The continuity of winding, low level insertion VSWR, and insulation resistance shall be measured and they shall be within the limits specified.

*Basic climatic and mechanical durability tests for electronic components (*revised*).

†Environmental tests for electronic and electrical equipment: Part XVII Simulated solar radiation at ground level.

APPENDIX A

(*Clause* 0.4)

INFORMATION TO BE GIVEN BY THE PURCHASER

A-1. The purchaser of high frequency wideband impedance matching transformers shall furnish information on the following items as are applicable:

a) Power and voltage levels;

b) Maximum insertion loss or minimum efficiency;

c) Size;

d) Source and load impedances;

e) Turns ratio or the desired ratio of impedances;

f) The lowest and highest operating frequencies and number of dB down with respect to the frequency. For certain applications, shape of the amplitude response is to be specified;

g) Either the permissible ripple, that is, the fluctuation of amplitude in the pass band or whether the response is to be flat;

h) The slope or rate of attenuation in the stop band;

j) Minimum attenuation in the stop band and the amount of repel, if any, beyond cut-off; and

k) When fidelity of wave shape is important, it may be necessary to specify the following:

1) Nature of the generator (for example, transistor, electron tube), its power capability or level, the class of operation (for example, *A*, *AB*, *B*) and the degree of unbalance *BC*;

2) Variation in input impedance of the loaded transformer at low and high frequencies;

3) Maximum phase shift in the pass band;

4) Maximum harmonic distortion contributed by the transformer core;

5) Whether feed-back is employed, if so, the amount of feed-back;

6) Whether the transformer is inside or outside the feed-back loop and the permissible phase shift in the stop band; and

7) Circuit (schematic), especially when the source or load is nonlinear or the circuit is complicated.

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2612-1965 Recommendation for type approval and sampling procedures for electronic equipment

6297 (Part I)-1971 Transformers and inductors (power, audio, pulse and switching) for electronic equipment: Part I General requirements and tests

6297 (Part II)-1973 Transformers and inductors (power, audio, pulse and switching) for electronic equipment: Part II Power trasformers.

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6297 (Part IV)-1974 Transformers and inductors (power, audio, pulse and switching) for electronic equipment: Part IV Pulse and switching transformers

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